II. PHYSICAL MARKET FUNDAMENTALS CREATE A VULNERABLE COMMODITY

To tell the complete story of natural gas prices we must understand the problems in the physical market and how they interact with financial markets. The analysis of the financial commodity markets must proceed within the context of the general nature of the commodity.

Energy commodities in general, and natural gas in particular, are produced and delivered under conditions that make them UNIQUE. Some of the practices and institutions that might be appropriate or acceptable for other commodities do not fit the situation of natural gas. The physical conditions of supply and demand interact powerfully. This is true for both "market forces" and behaviors that seek to manipulate or move markets. As the author of a comprehensive economic theory ABOUT manipulation of commodities noted, "the profitability of manipulation varies with certain structural variables, such as transportation costs, demand and supply elasticities, commodity flows, storage costs, and intertemporal consumption preferences."[1]

In the natural gas market, a number of structural variables are arrayed to the disadvantage of the consumer. Some of these structural variables are inherent in the nature of the technology of finding, delivering and using the commodity. Some of the structural variables are directly the result of public policy choices and strategic actions.

Basic conditions on the supply-side of the physical market include the low elasticity of supply and important sources of friction in the delivery of the product – high transportation and storage costs, as well as constraints on transportation and storage options. Basic conditions on the demand-side include a low elasticity, lack of substitutes, and a strong seasonality of demand. Market structural conditions that reflect public policy include concentration and the ownership of the commodity by large traders, as well as institutional factors that constrain actions by important market participants. This section examines the physical market, starting from the burner tip (demand) and working back through the delivery infrastructure to the wellhead (supply).

A. DEMAND

1. Consumption

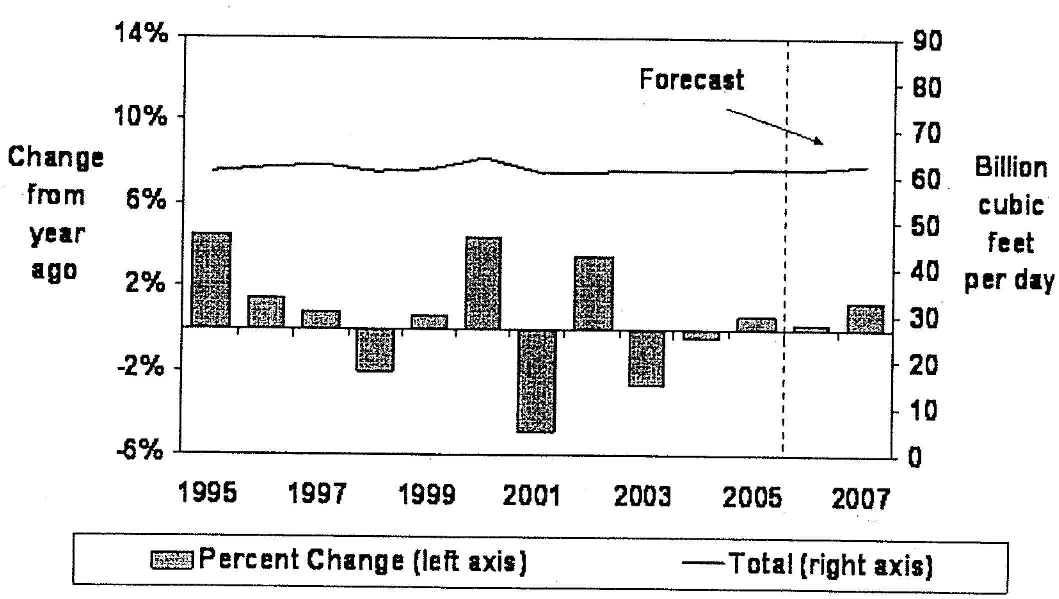
A tight market for a commodity like natural gas is dangerous for consumers. Natural gas is a vital necessity, which means that it has a low price elasticity of demand and a moderate-income elasticity of demand. As the price rises, it is very difficult for consumers to cut back and they suffer a loss in welfare as the cost eats up a larger part of their income. Residential consumers use natural gas primarily for heating and, increasingly, indirectly for electricity. Demand is generally predictable in a seasonal pattern. The amount consumed by residential users is dictated in large part by the kinds of buildings in which they live and work and the energy efficiency of the appliances they use. Natural gas is a feedstock for industrial uses for which substitution is difficult, at best. Natural gas has been the fuel of choice in the electricity industry for about a decade, particularly for facilities to meet peak demand. This increased consumption by gas-fired generating plants shifted the pattern of demand more heavily into the summer months. As a result, it has become more expensive to put gas in storage in preparation for the winter heating season.

Demand is quite inelastic – large increases in price elicit small changes in demand. Short-term elasticities are in the range of -0.3; long-term elasticities are in the range of -0.6 and less than one in the aggregate.[2] What this means is that a ten percent increase in the price of gas results in a 3 percent decline in demand. The low elasticity of demand is the critical factor in rendering the energy market volatile and vulnerable to manipulation.

The elasticity of demand is also important in another respect. It underlies the pattern of demand growth across time. Demand has been flat, at most growing slightly over the past decade (see Exhibit II-1). There has also been a slight dampening of the seasonal pattern as more gas is consumed during summer months to generate electricity.

EXHIBIT II-1: NATURAL GAS DEMAND: 1995-2005

Figure 12. Total U.S. Natural Gas Demand Growth



Short-Term Energy Outlook, January 2006

www.eia.doe.gov

The misimpression of soaring demand may have been created by the building of natural gas fired electricity generating plants. While use in this sector did increase, the use of gas did not for at least three reasons. First, some of the more efficient new gas-fired plants displaced older, inefficient gas-fired plants. Second, some of the new plants did not fire-up much because of their high operating costs. That is why they are being sold as distressed assets. Third, there has been a great deal of demand destruction in the industrial sector.

The shift form industrial load to natural gas-fired plants shifts load to the summer, which may make it harder to find gas to put into storage. Summer was a slack period. In this sense, it is filling the valleys. The shift in demand may also shift the need for physical facilities to transport gas new locations. The image of "soaring" demand for gas to be consumed at the burner tip as the cause of the sharp price-run up price is simply wrong. Soaring demand in terms of hedge funds and speculators expanding their trading of gas contract as a cause of the price increase is being fiercely debated.

The most recent short-term energy outlook from the Energy Information Administration makes this point quite clearly. The past three years, which have seen the most dramatic increase in prices, have had a net decline in consumption. The claim of surging demand cannot be squared with reality. The response to the price increases of recent years has been inelastic – a very small reduction in the face of a very large price increase.

2. Distribution Infrastructure

Supply is equally inelastic, with long lead times needed to find and develop resources and the capital-intensive infrastructure (pipelines and storage facilities) to deliver it. Transportation and storage are expensive and difficult. Because natural gas is consumed in large quantities, huge sums of money can change hands very quickly as the price rises.

Many sources of energy are located far from consumers, requiring transportation over long distances. Energy supplies are expensive to transport and to store. Because of the nature of the underlying molecules, the production, transportation and distribution networks are extremely demanding, real-time systems. These systems require perfect integrity and real-time balancing. Transportation, storage and distribution infrastructure is extremely capital intensive and inflexible, relying on networks that are sunk in place with limited ability to expand in the short and medium term because of long lead times to build.

These physical and economic characteristics render the supply-side of the market inelastic.[3] Unlike financial instruments, which are simply pieces of paper that can be stored or moved with extreme ease, energy commodities are difficult and costly to move and store. Physical transactions involve a great deal of friction. This is the critical factor in the financial market.

> Economic frictions (including transportation, storage, and search costs) which impede the transfer of the underlying commodity among different parties

> separated in space or time can create the conditions that the large trader can exploit in order to cause a supracompetitive price.[4]

Given the basic infrastructure of supply in the industry, the availability of excess capacity and stocks to meet changes in demand is the critical factor in determining the flexibility of supply. "All else equal, the lower the storage costs for a commodity, the more elastic its demand."[5]

One recent study found the volatility of natural gas prices to be greater than oil prices because of the nature of the infrastructure required to deliver natural gas to consumers:

> The dependence of natural gas on more inflexible sources of supply and the greater role of transportation opens the window to profiteering. It appears that volatility in natural gas returns is more persistent than volatility in oil returns. By itself, this result suggests that there may be a "larger window of profit opportunity" for investors in natural gas than in oil....
>
> [N]atural gas return volatility responds more to unanticipated events (e.g. supply interruptions, changes in reserves and stocks, etc.), regardless of which market they originate in.[6]

The bottom line is that the existence of friction and volatility opens the door to profit opportunities. "If prices and thus returns rise in response to volatility, there may be immediate profit opportunities in natural gas following shocks in either market."[7] These opportunities attract traders to enter the market and give those in the market an incentive to exploit the frictions and shocks.

Because natural gas is a physical commodity that is actually consumed (unlike a pure financial instrument), is difficult to store and expensive to transport, natural gas markets are complex. A recent book entitled *Energy Risk* identifies the uniqueness of energy markets, comparing energy commodities to more pedestrian financial instruments like stocks and bonds. The key elements identified are the supply-side difficulties of production, transportation and storage, and the demand-side challenges of providing for a continuous flow of energy to meet inflexible demand, which is subject to seasonal consumption patterns.

> [T]he deliverables in money markets consist of a "piece of paper" or its electronic equivalent, which are easily stored and transferred and are insensitive to weather conditions. Energy markets paint a more complicated picture. Energies respond to the dynamic interplay between producing and using; transferring and storing; buying and selling – and ultimately "burning" actual physical products. Issues of storage, transport, weather and technological advances play a major role here. In energy markets, the supply side concerns not only the storage and transfer of the actual commodity, but also how to get the actual commodity out of the ground. The end user truly consumes the asset. Residential users need energy for heating in the winter and

> cooling in the summer, and industrial users' own products continually depend on energy to keep the plants running and to avoid the high cost of stopping and restarting them. Each of these energy participants – be they producers or end users – deals with a different set of fundamental drivers, which in turn affect the behavior of energy markets...
>
> What makes energies so different is the excessive number of fundamental price drivers, which cause extremely complex price behavior.[8]

A recent article in an investor newsletter under the headline "Investors Beware" offered a strong warning about the uniqueness of energy commodities. "There are four fundamental characteristics of energy markets that investors must understand before investing in energy: 1. Valuation is more challenging, 2. Data is less transparent, 3. Energy is more volatile, 4. Trades are more operationally complex."[9]

Complexity of physical characteristics translates into a highly vulnerable product in this commodity market.

> Although the formal analysis examines transportation costs as the source of friction, the consumption distortion results suggest that any friction that makes it costly to return a commodity to its original owners (such as storage costs or search costs) may facilitate manipulation.
>
> The extent of market power depends on supply and demand conditions, seasonal factors, and transport costs. These transport cost related frictions are likely to be important in many markets, including grains, non-precious metals, and petroleum products.
>
> Transportation costs are an example of an economic friction that isolates geographically dispersed consumers. The results therefore suggest that any form of transactions cost that impedes the transfer of a commodity among consumers can make manipulation possible. [10]

B. Supply

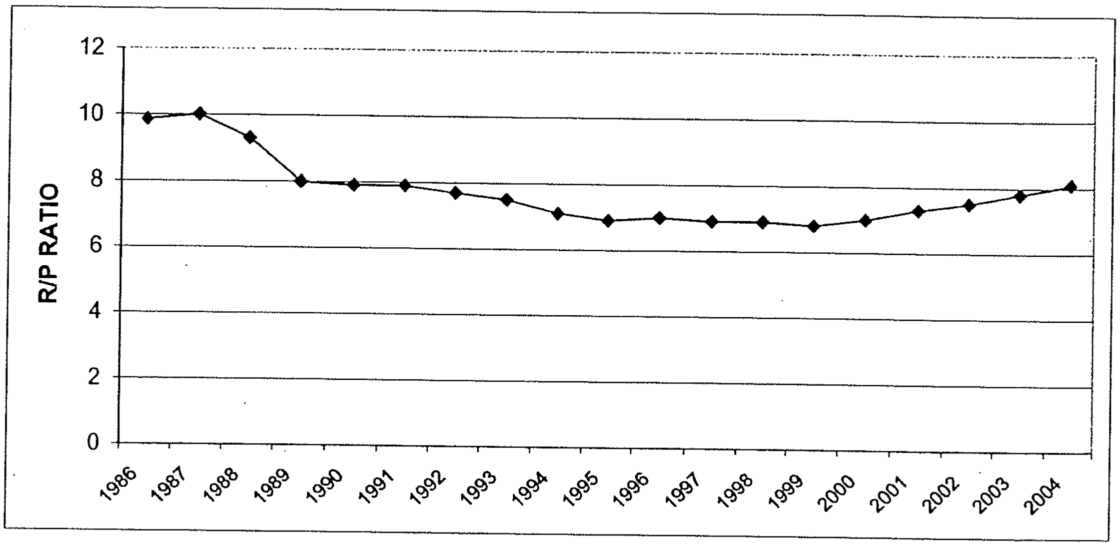
1. Reserves and Resources

Tightness of supplies in the physical market plays a role, but why supplies are so tight, how long that will last and how high prices should be as a result are hotly debated. At present, consumers are paying excessive prices far above the cost of production."[11]

The trend of demand is hardly a shock and most markets are equipped to handle it well. Thus, the physical market problem, if there is one, is on the supply-side. Although the resource base in the U.S. is "mature," it has certainly not collapsed or dried up. The market became tight primarily because the supply side resource did not keep up with production.

As Exhibit II-2 shows, throughout much of the 1980s and early 1990s, reserve additions failed to keep pace with production. In the mid-1990s, additions to reserves equaled production. In the past five years reserve additions have exceeded production, although that has come about from extensions of existing fields rather than finding new ones. Can these modest changes in physical fundamentals account for a quadrupling of price in such a short period of time?

EXHIBIT II-2: NATURAL GAS RESERVE TO PRODUCTION RATIO

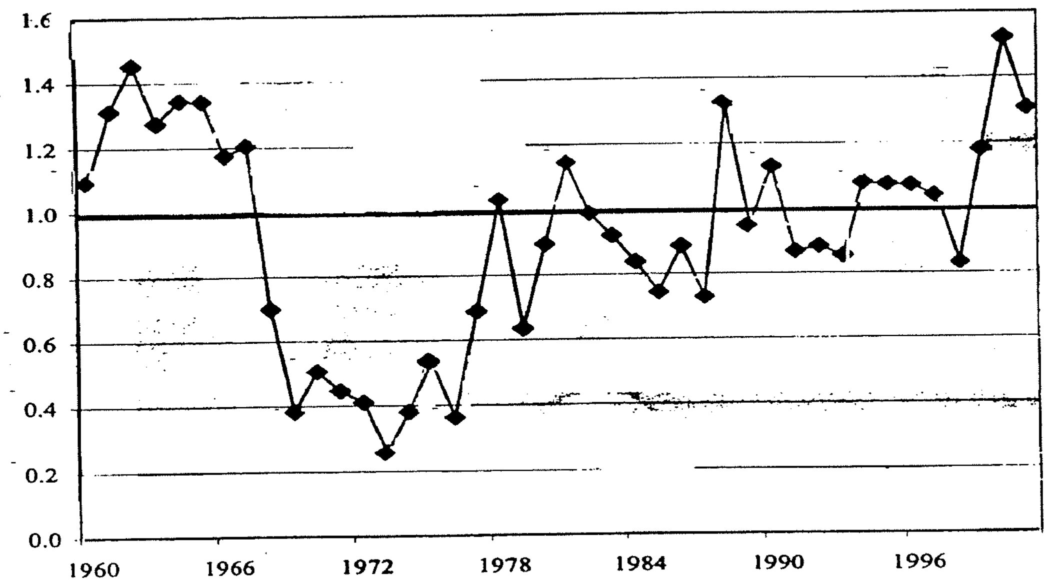


Source: Energy Information Administration, database.

Long-term trends do not suggest a major change. For example, the Stanford Energy Modeling Forum points out that the long-term trend of reserve replacement is not consistent with the extremely pessimistic view taken by the industry (see Exhibit II-3). Similarly, the most recent report of the Potential Gas Committee, which has been analyzing the natural gas resource base for a quarter of a century, does not suggest such a gloomy picture. The biennial report of the Potential Gas Committee of September 2005,

> shows total probable, possible and speculative traditional gas resources of 950.0 Tcf and another 169.3 Tcf of potential coalbed gas resources in the U.S. (including Alaska).... That is the equivalent of 68 years of production at current rates, and represents nearly the same total reserve base estimated in 2002....
>
> "The 2004 assessment reaffirms the Committees evaluation of an abundant U.S. natural gas resource potential," said John Curtis, Director of the Potential Gas Agency at the Colorado School of Mines, which provides guidance and technical assistance to the PGC...

EXHIBIT II-3: NATURAL GAS REPLACEMENT RATE (=Additions/Production)



Source: Energy Modeling Forum, *Natural Gas, Fuel Diversity and North American Energy Markets*, September 2003, Figure 2.

The size of the resource base today remains roughly the same as estimated in the committee's year-end 2002 numbers, but 38 Tcf of natural gas was drawn down since that time. Factoring in the past two years' production, PGC has increased its estimate of the U.S. gas resource base with each successive report over the last 12 years or more.[12]

2. The Industry Flip-Flop on Price

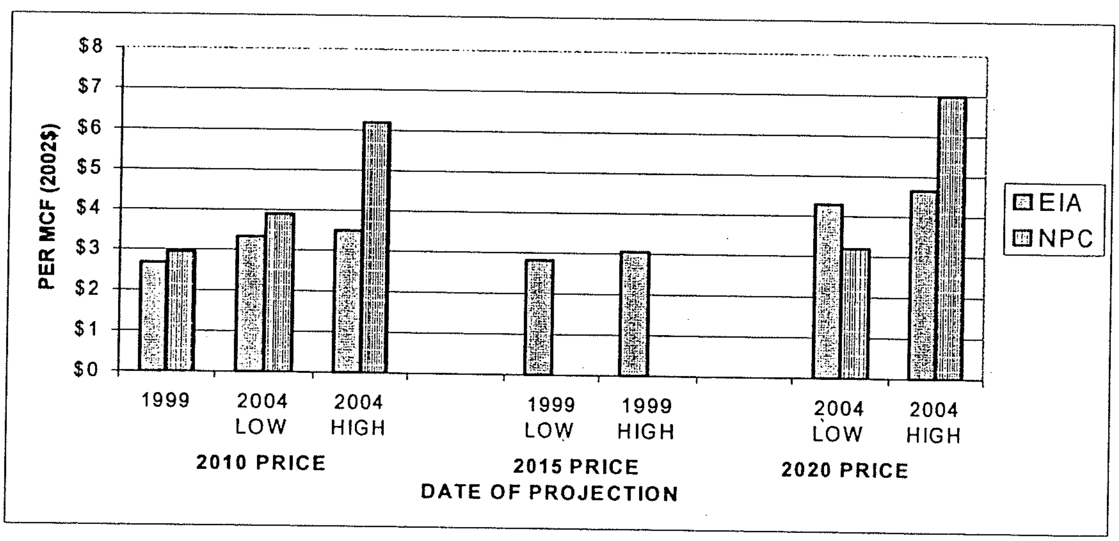
The National Petroleum Council (NPC) released a report in late 2003 that dramatically raised the estimated cost of finding and producing new natural gas supplies. This provided a perfect rationale for rising prices. The NPC is "a federally chartered and privately funded advisory committee," whose purpose "is solely to represent the views of the oil and natural gas industries in advising, informing, and making recommendations to the Secretary of Energy with respect to any matter relating to oil and natural gas, or to the oil and gas industries submitted to it or approved by the Secretary."[13] It is composed of integrated oil companies (18), large independent oil and gas producers (44), small independent oil and gas producers (83), natural gas companies (38), independent oil transporters, refiners and marketers (26), construction, drilling and oilfield support-service companies (41), financial and consultant support service companies (40), electric companies and other large consumers (8), and non-industry members (39).

In essence, the NPC asserts that the resource base threw the industry a curve. The NPC contends that the industry was surprised by the difficulty and cost of finding new gas. Caught off guard, there has been a surge in prices that will become permanent unless dramatic changes in policy are made. These changes would generally raise the profitability of the petroleum industry by lowering its costs of production. This was a dramatic shift from previous policy that criticized by others.

Exhibit II-4 shows that the 2003 NPC report represented a sharp shift in its estimate of the cost of finding natural gas by contrasting the 1999 estimates of future wellhead prices by the NPC and the Energy Information Administration to the later estimates by the same bodies. The 1999 projections came at a key moment. The increase in gas-fired electricity generation was becoming apparent and concerns were expressed about whether production could keep pace. The reports were also written just before prices began to rise sharply and become volatile.

Both the EIA and the NPC were quite optimistic in 1999. Projecting prices in the range of $2.80 to $3.80, the NPC concluded that "sufficient resources exist to meet growing demand well into the twenty-first century."[14] The EIA projected prices less than $3 in its *Annual Energy Outlook*, wherein the section headings shed extra light on the attitude – "Rising Gas Prices and Lower Drilling Costs Increase Well Completions, High Levels of Gas Reserve Additions Are Projected Through 2020, Significant New Finds Are Likely To Continue Increases in Gas Production."[15]

EXHIBIT II-4: THE DRAMATIC SHIFT IN PROJECTED WELLHEAD PRICES



Source: National Petroleum Council, *Natural Gas: Meeting the Challenges of the Nation's Growing Natural Gas Demand* (December 1999), p. 20, *Balancing Natural Gas Policy* (September 2003), p. 14; Energy Information Administration, *Annual Energy Outlook 2000* (December 1999), Table C-14, *Annual Energy Outlook* (January 2004), Table C-14.

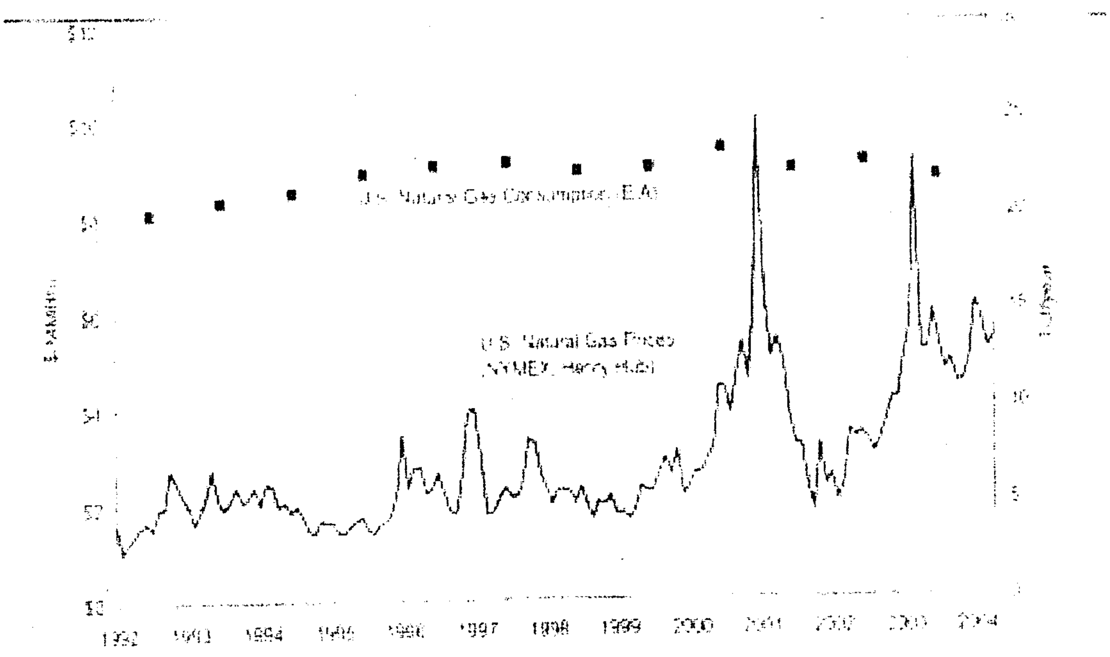
The tone in the 2003/2004 reports was considerably different. The EIA added a dollar to its projected prices and the NPC added over two dollars. The NPC declared that "North America is moving to a period in its history in which it will no longer be self-reliant in meeting its growing natural gas needs,"[16] while the EIA report opened with a cautious note:

> For almost 4 years, natural gas prices have remained at levels substantially higher than those of the 1990s. This has led to a reevaluation of expectations about future trends in natural gas markets, the economics of exploration and production, and the size of the natural gas resources. The *Annual Energy Outlook 2004* forecast reflects such revised expectations, projecting greater dependence on more costly alternative supplies of natural gas.[17]

3. Other Views of the Supply-Demand Balance

The NPC claims that "Current higher gas prices are the result of a fundamental shift in the supply and demand balance.... [that] will result in undesirable impacts to consumers and the economy, if not addressed."[18] Others correct the record, pointing out, as Exhibit II-5 shows, that,

EXHIBIT II-5: U.S. NATURAL GAS DEMAND AND PRICES

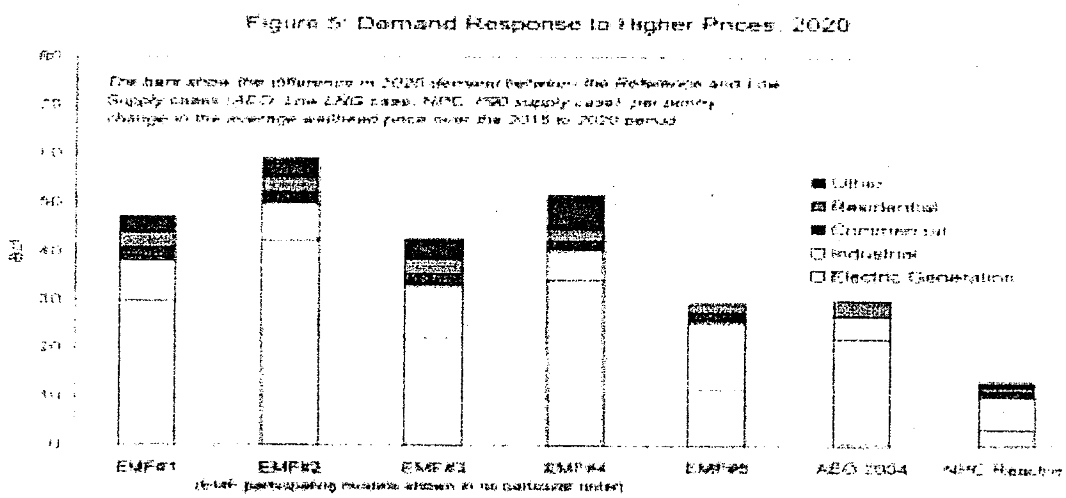


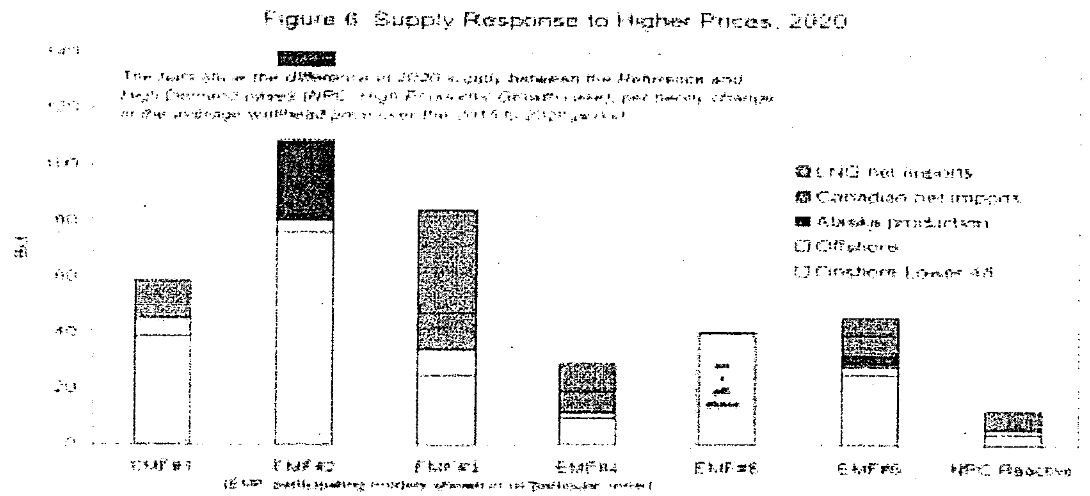
Source: Ken Costello, Hilliard G. Huntington and James F. Wilson, *After the Natural Gas Bubble: A critique of the Modeling and Policy Evaluation Contained in the National Petroleum council's 2003 Natural Gas Study,* July 8, 2004, Figure 1.

to be clear, however, the fundamental shift in the NPC outlooks has been in supply, not in demand.... In the 2003 NPC Report, the resource base assessment for the Lower-48 and Canada has been reduced by 20%... The NPC forecast of U.S. gas consumption... has been reduced by over 15% compared to the 1999 report, while prices are expected to be 40% to 70% higher than anticipated in the 1999 report."[19]

The NPC's shift from optimism to pessimism about the supply-demand balance rests on assumptions about the behavior of the natural gas market that are not consistent with historical experience. These assumptions are not shared by others (see Exhibit II-6). As we

EXHIBIT II-6: THE NATIONAL PETROLEUM COUNCIL NATURAL GAS STUDY DRAMATICALLY UNDERESTIMATES MARKET RESPONSES TO PRICE INCREASES





Source: Ken Costello, Hilliard G. Huntington and James F. Wilson, *After the Natural Gas Bubble: A critique of the Modeling and Policy Evaluation Contained in the National Petroleum council's 2003 Natural Gas Study,* July 8, 2004, Figures 5 and 6.

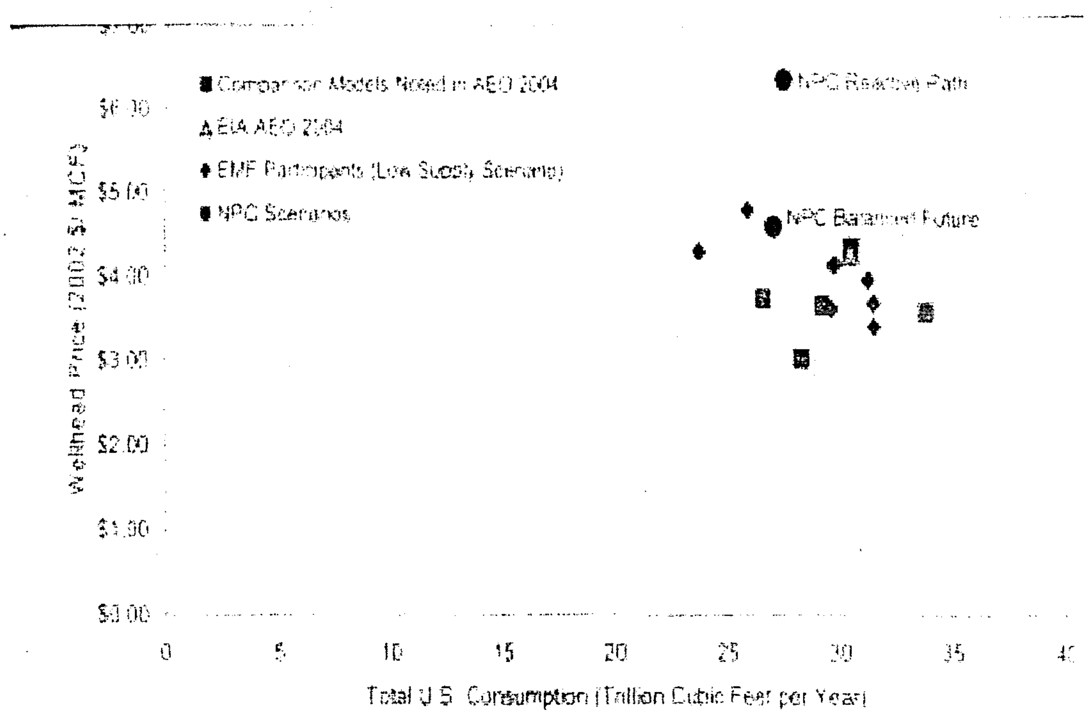
have seen, the data from the most recent years reinforces this observation. The NPC's pessimism is driven by extremely pessimistic assumptions about the supply and demand responses to price changes.

4. The Cost of Production

The fact that the NPC's price projections are fifty percent higher in their base case than most others should not obscure a more important observation. There was a consensus that prices over the next twenty years would be in the range of $4.50 (in 2002 dollars) per mcf. With today's wellhead prices running in the range of $7.50 to $10 per mcf, $4.50 may not sound like a big number, but it still represents more than a doubling of the price compared to the previous twenty years. Recently, the EIA has raised its estimate of the cost of natural gas production to $5.50.

Other analyses offer a different view. Some analysts project the underlying costs at much lower levels than the industry. Exhibit II-7 shows the sharp difference between the

EXHIBIT II-7: COMPARISON OF NATURAL GAS OUTLOOKS, 2020

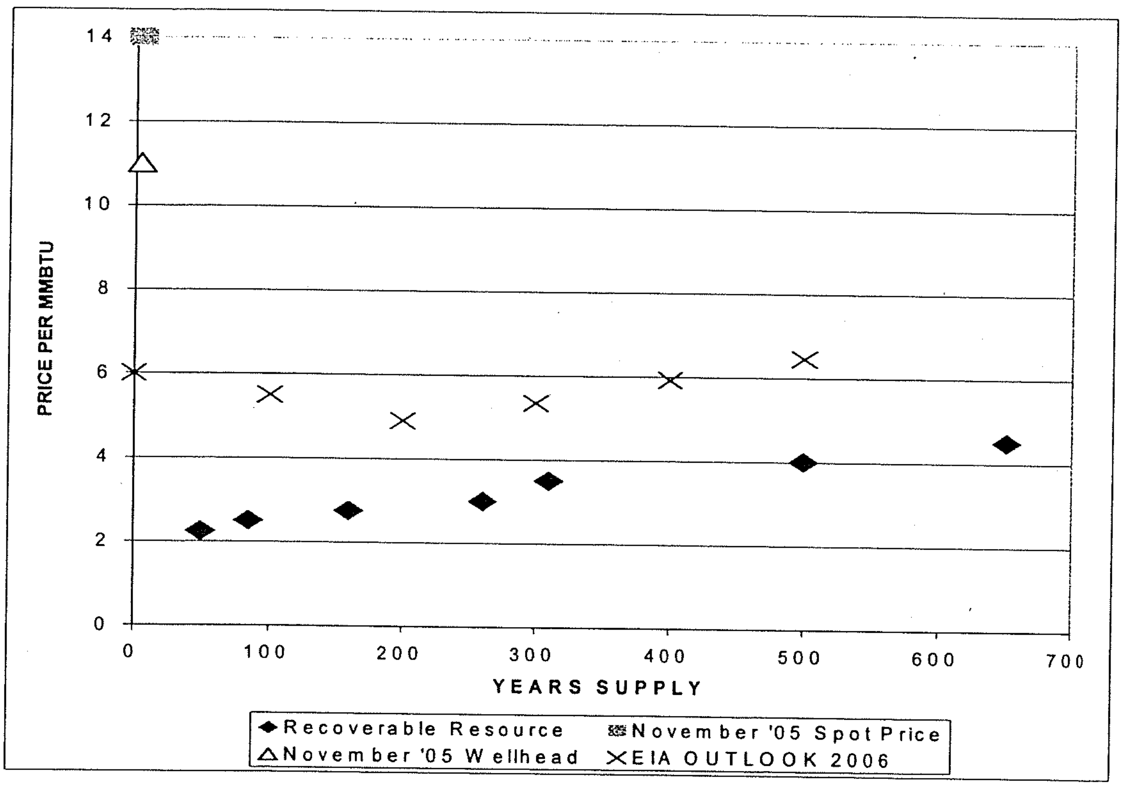


Source: Ken Costello, Hilliard G. Huntington and James F. Wilson, After the Natural Gas Bubble: A Critique of the Modeling and Policy Evaluation Contain in the National Petroleum Council's 2003 Natural Gas Study, July 8, 2004. Figure 3.

National Petroleum Council price projection and a number of other studies, including those by the Energy Information Administration.

Exhibit II-8 shows mid-point estimates for the full-cycle cost of gas recovery plotted as the number of years of resource recoverable at an annual consumption of 25 trillion cubic feet. Note that Exhibit II-8 is quite consistent with Exhibit II-7 in that it shows a resource cost in 2020 at production levels of 25 to 30 trillion cubic feet (TCF) of about $4.00 per mmBtu. Exhibit II-8 also presents the most recent EIA estimate of the cost of production across time, assuming that approximately 100 Tcf is produced in each five-year period. Thus, 2010 is plotted at the 100 Tcf point; 2015 is plotted at the 200 tcf point, etc.

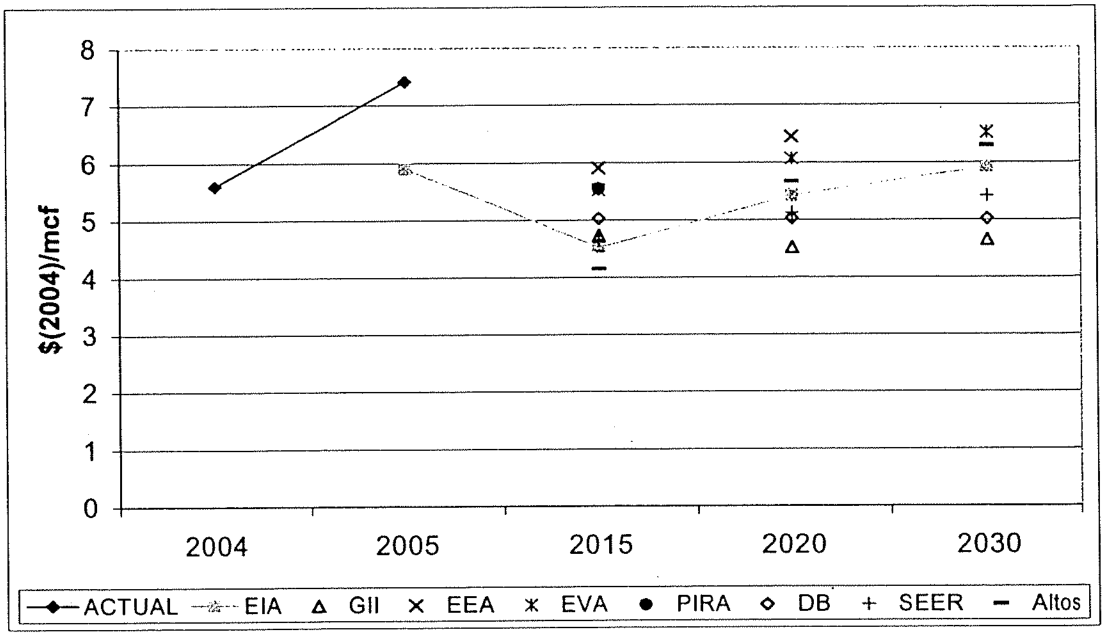
EXHIBIT II-8: DISLOCATION IN NATURAL GAS MARKETS



Sources: Energy Information Administration, *Annual Energy Outlook: 2006*, February 2006, James R. Choukas-Bradley and Michael F. Donnelly, *A Report on Projected Natural Gas Prices and Dynamics of the Natural Gas Markets for 2005 and Beyond*, February 11, 2005, NyMex

Current prices are far in excess of the estimated resource costs of production. Exhibit II-9 compares the EIA estimates of costs to estimates prepared by other petroleum industry analysts. The numbers are presented in constant 2004 dollars. The gap in 2005 of $2.50 per mcf is equal to about $50 billion for the year. Prices for this year (known as six and twelve month strips) are above last year. Prices for the next couple of years are higher still. In other

EXHIBIT II-9: PROJECTED NATURAL GAS PRODUCTION COSTS



Source: Energy Information Administration, *Annual Energy Outlook 2006: With Projections to 2030,* February 2006, Table 23, EIA *Natural Gas Database* for actual 2005 prices. GII = Globabl Insight Inc.; EEA = Energy and Environmental Analysis, Inc.; EVA = Energy Ventures Analysis Inc.; PIRA = PIRA Energy Group; DB = Deutsche Bank, AG; SEER = Strategic Energy and Economic Research; Altos = Altos Partner North American Regional Gas Model.

words, there are hundreds of billions of dollars at stake in the current dislocation in the natural gas market.

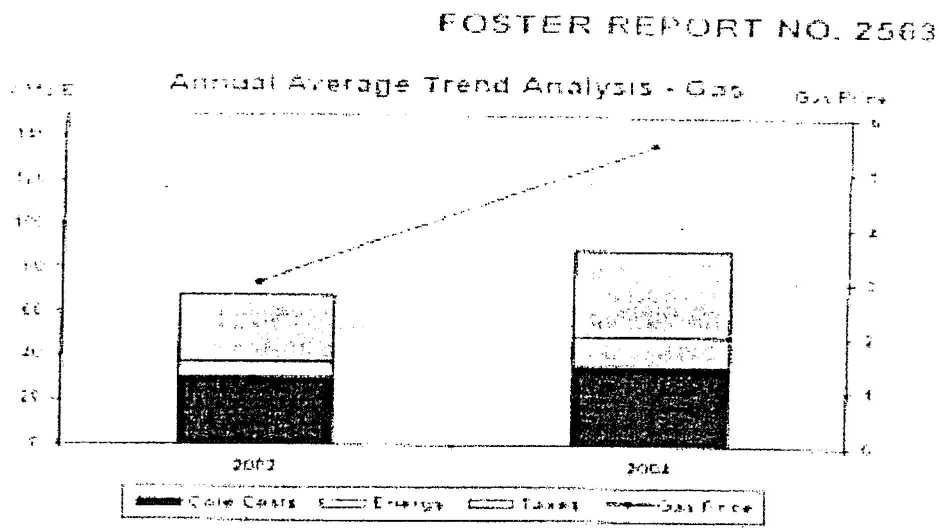
Other estimates of short run changes in the resource base and the cost of production also give a different perspective on the resource base and the cost of production. As noted earlier, the Potential Gas Committee estimates almost a three percent increase in proved reserves over the past two years and virtually no change in total supply, notwithstanding the fact that approximately 38 bcf had been produced in that period.[20]

Ziff Energy Group, which studies the economics of field operations, also observes increases in natural gas production from mature basins.

> The Permian Basin is considered to be the largest onshore U.S. oil-producing region, despite a steady decline in annual production since its peak in 1973. During the past 5 years, there has been a trend to increasing gas production, both from shallow horizons (e.g. Sonora area) and deeper reservoirs (e.g. Ellenberger).[21]

Ziff Energy's Study of increasing costs in these areas also shows that price increases at the wellhead have greatly exceeded cost increases (see Exhibit II-10).

EXHIBIT II-10: OPERATING COSTS AND PRICES



Source Foster Report, No. 2563, October 20, 2005.

> According to a new report issue by Ziff Energy Group, producer operating costs in the Permian basin have increased significantly... The 2004 average operating cost for gas fields increased 31% to nearly 90 cents/MCF. By contrast, leasing gas field operators achieved average costs of less than 60cents/ Mcf.[22]
>
> Ziff Energy Group's 12th annual study of oil and gas fields in Western Canada quantified a significant increase in operating costs. The largest increase in 2004 was for exploration and operation of natural gas prospects – the weighted average increased 12%, to over $0.80/Mcf [$0.82/Mcf]. Main drivers of the cost increase were the many services expenses due to high levels of field activity and higher energy costs.[23]

In contrast to the increase of operating costs of about 30 cents/mcf, the price increase enjoyed by producers was approximately $2.50.

The gap between near-term prices in the range of $7.00 to $10.00 per mmBtu and the underlying costs of production is striking. Those who predict a lower full cycle cost for gas naturally tend to predict that prices will fall sharply, under the assumption that the real economics must overcome a temporary decoupling of prices from costs. That begs the question, however, of how the disjuncture came about in the first place. Without a good explanation of how the disconnect came to be, the mechanisms by which the gap can be closed are uncertain and the promise that it will be closed is subject to question. This gap also raises doubts about the claim that access to low cost supplies in environmentally sensitive areas will lower prices. With prices so far above costs, it is easy to doubt that lowering the cost of production will make much difference, other than to increase the profits of the gas producers.

C. Supply as a Strategic Variable

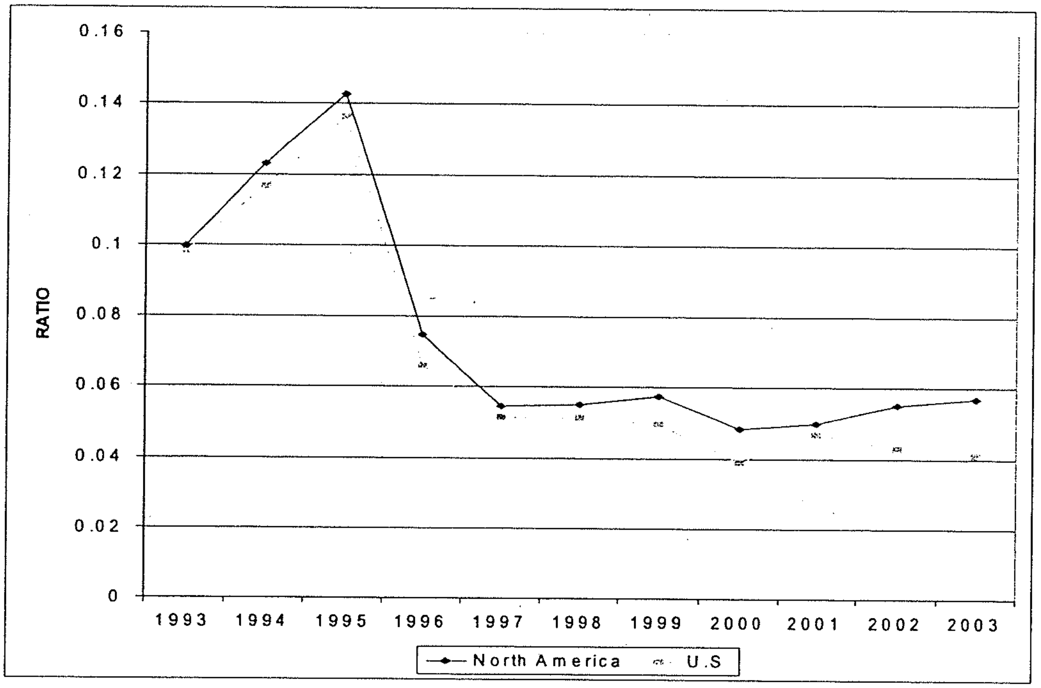
One explanation for the gap between costs and prices is that changes in industry structure, incentives, and behavior led to a slowdown in efforts to bring gas to market and a run-up in price. If this is correct and the incentives and structures do not change, then market performance will continue to disappoint.

The physical resource base in the U.S. is mature and experiencing increasing costs of discovery and development, but the physical changes are not large enough to account for the rising price. Demand is growing and has shifted slightly, which puts additional pressure on the resource base, but not enough to account for the tightness of supply or the increase in prices. One recent analysis attributed declining capacity to the interaction of the mature resource base and sluggish investment.

> "Effective production capacity is defined as the maximum production available from natural gas wells considering limitations of the production, gathering, and transportation systems," the report says. Although production increased to 52 Bcf/d in 2001, from 45 Bcf/d in 1985, effective production capacity has declined to 56 Bcf/d from 61 Bcf/d for that same period. ESAI [Energy Security Analysis Inc.] attributes the decline in capacity to a period of fewer increment well completions during the 1990s combined with the "treadmill effect" of maturing basins.[24]

Structural and behavioral changes on the supply-side of the market have contributed to the tightness of supply. When "The Majors' Shift to Natural Gas," as an EIA document put it, behavior in the industry changes. With the entry of major producers into the market, investment patterns changed and investment decisions now determined the state of the resource base (see Exhibit II-11). Investment decisions largely determined the state of the resource base. With majors shifting their focus in the late 1990s, production exceeded reserve additions, creating the condition for a tightening of the market. Investment shifted from exploration to development and extension. When prices began to rise, the response was slow. As Standard and Poor's noted in 2004:

EXHIBIT II-11: RATIO OF EXPLORATION TO DEVELOPMENT WELLS



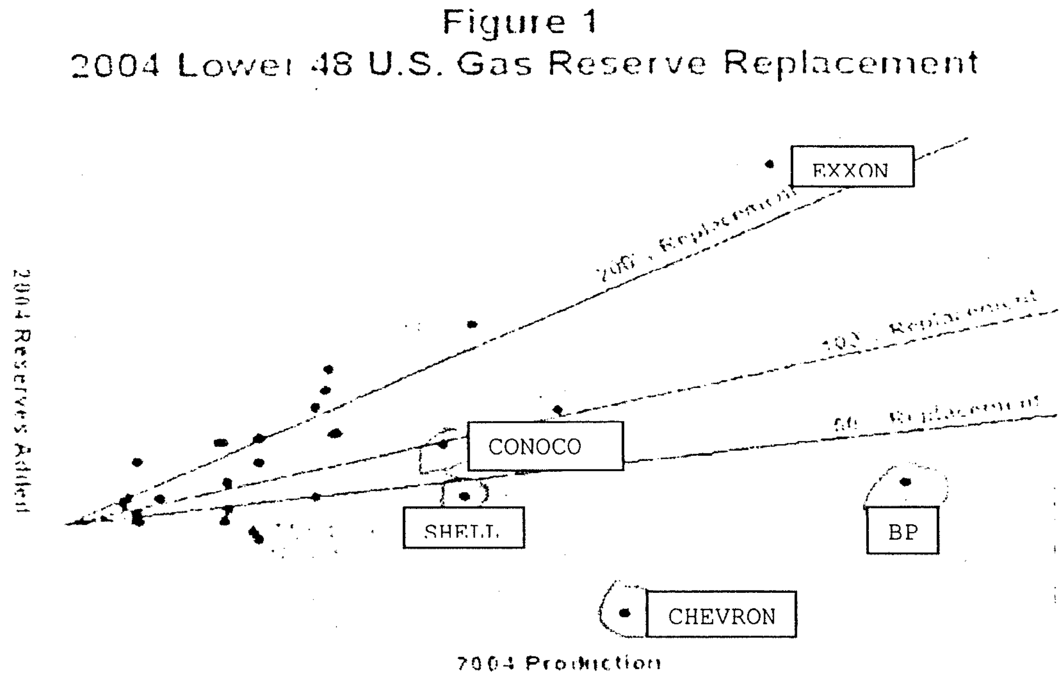
Source: Energy Information Administration, *Performance Profiles of Major Energy Producers*, various years

> It is unclear that producers are investing enough to grow production materially – and this follows a year [2003] in which the domestic gas production (including acquisitions) of integrated producers appears to have declined…
>
> [M]ajor integrated companies, which appear to be reinvesting only 30 to 40 percent of their domestic cash flow in the United States, have made strategic decisions to allow their shallow-water and onshore natural gas production to deplete to redeploy capital to international (mainly oil) projects.[25]

A recent *Wall Street Journal* story provides good context. Under close scrutiny, following gasoline price increases, reports of record third quarter profits, and consumer outcry facing dramatic increases in winter heating bills, the WSJ reported that "Big Oil Firms Join Hunt for Natural Gas in the U.S."[26] But why has it taken a decade and a tripling of price to get them into the hunt? Complaints about underinvestment in domestic U.S. natural gas resources have been mounting for years.

Exhibit II-12 shows that as recently as 2004, the majors were lagging in the effort to replace their reserves. The circled entities are the four remaining majors — BP-Arco-Amoco, Exxon-Mobil, Chevron-Getty-Texaco, ConocoPhilips. Listing the names reminds us of how

EXHIBIT II-12: THE MAJORS LAG IN RESERVE REPLACEMENT



Source: Foster Reports, 2544, June 9, 2005, p. 22

many firms disappeared in the merger wave of 1996-1002. Indeed, there is growing belief that "[p]roducing areas are active merger and acquisition targets"[27] because of the huge run-up in prices. The next wave of mergers may affect large and small firms alike.

> U.S. exploration-and-production companies flush with cash thanks to lofty commodity prices will likely step up their participation in mergers and acquisitions during the coming year, analyst Irene Haas said in a report Friday.
>
> "We believe M&A activity will intensify in 2006," said Haas, of Houston-based Sanders Morris Harris. "Most of the large integrated and larger majors are building up cash. After having gone through the exercise of debt reduction, share buybacks, and dividend increases, the companies are still looking at sizeable cash flow…

"We believe that this cash build-up, and the lack of attractive new places to invest, will fuel more merger and acquisition activities."[28]

Looking at capital spending patterns for both exploration and acquisitions, the authors noted that "M&A spending did draw a greater share of the funds, nearly all at the expense of development outlays."[29] Having allowed the price to rise to extreme levels, it became highly profitable for large oil firms to suddenly rediscover the U.S. resource base.

In the past few months, BP and Exxon have committed to long-term developments of U.S. fields they have held for years but haven't given much attention to....

While tapping these new gas reserves probably will require costly technology, the high price of natural gas in the U.S. makes the investment attractive. In New York, natural gas has been trading well above $10 per million British thermal units since late August, more than quadruple its price at the beginning of the decade. Prices are expected to stay high for years.

"The pricing outlook for North American natural gas is so favorable that these projects are very attractive." [30]

Drilling activity does respond to price increases, but it has been muted (see Exhibit II-13). Since 1999, which saw the lowest natural gas price in the past decade, there has been a doubling of the rig count, compared to a six-fold increase in the price of oil and a similar increase in the price of natural gas. Nevertheless, the rig count was higher in 1996-1999, when the oil price was less than half of what it is today. The implicit elasticity of supply of rigs with respect to price is considerably less than one. Rigs drilling for natural gas show both a faster rate of growth, but also a larger price increase.[31]

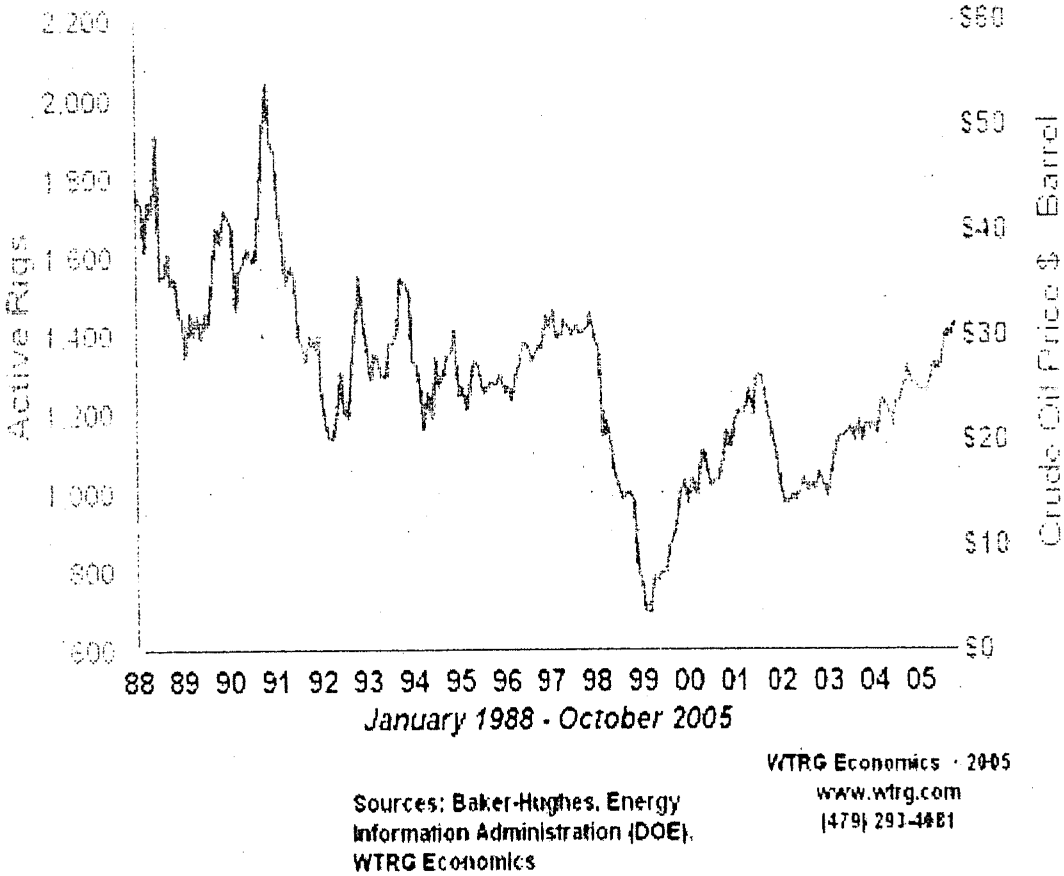
The long period of low levels of drilling, followed by the rapid expansion, contributes to the inefficient and sluggish response. Capacity is destroyed during the down cycle and then the rush to increase capacity increases the cost.

"When price returns get high enough people expand capacity. The returns are the highest we've seen for land rigs in a few decades..." Manufacturers building new rigs can expect a return of 25% to 30%.[32]

Drilling rig day rates have doubled since 2000 and new rigs are available only if a producer is willing to guarantee long-term leasing at these higher rates.[33]

The massive run up in prices of recent years has resulted in a huge throw off of cash, which is not being put back into the industry. As an analysis in the *New York Times* under the headline "High Profits, Sluggish Investments,"[34] pointed out after the announcement of yet more record profits, "The real issue, though, is not how much the oil companies are making, but what they are doing with the money. In too many cases, they seem to have only a limited

EXHIBIT II-13: U.S. WORKING RIG COUNT

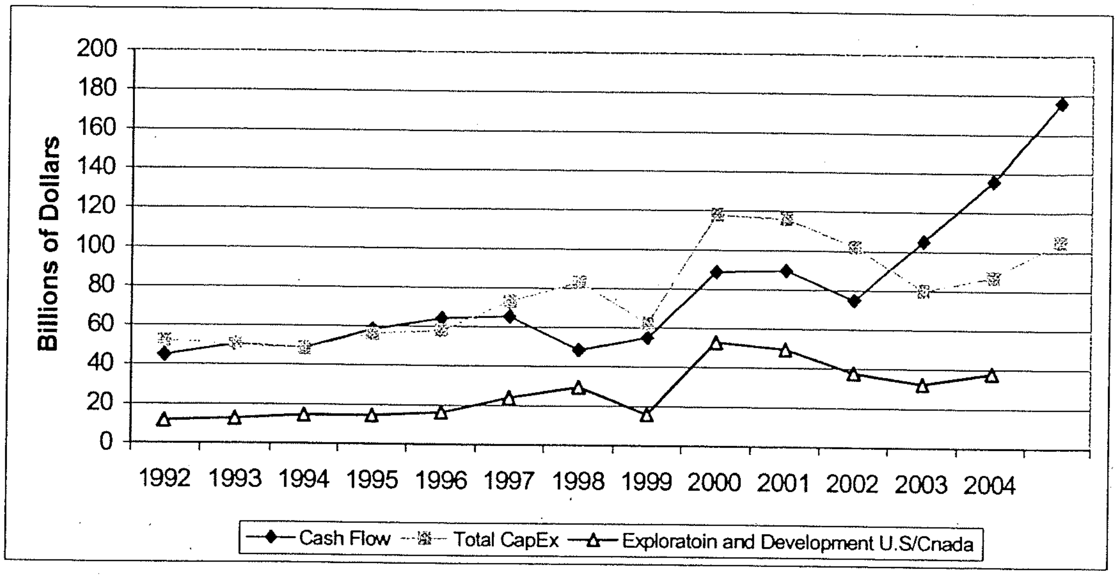


interest in investing it in projects that might help prevent or ameliorate a new energy crisis."[35] The article points out that Exxon essentially decides what to invest based on its projections of prices and "Exxon's price forecasts have not risen much in recent years, even though market prices have soared."[36] The dramatic shift in behavior among the majors is also unprecedented. "I checked back to 1976, and found that until 1997, Exxon always invested more than it made. Now it invests less than half of its profits."[37]

Exxon's ability to choose its target price, and not fear that it will lose out to others, who act more aggressively, is one indication of its market power. The fact that Exxon invested more than it earned until the onset of industry consolidation in the mid-1990s underscores the fact that companies generally use two major sources of cash to invest in an industry. Depreciation – the return of capital – is a major source.

The picture is even more distressing when one looks at cash flow – which is made up almost entirely of the return of and on capital. When an investment is depreciated, the capital is returned to the investor. This return of capital is a major source of cash flow. Return on capital is the income that companies earn. As Exhibit II-14 shows, the majors simply cannot

EXHIBIT II-14: CASH FLOW AND CAPITAL EXPENDITURES



Source: EIA, *Performance Profiles of Major Energy Producers,* various issues; 2005 estimated based on year-over-year changes for Exxon-Mobil, Shell, and Chevron reported in initial annual reports for 2005.

absorb the flood of cash. The increase in expenditures on exploration and development in the U.S. and Canada, which will do the most for natural gas markets in the U.S., is dwarfed by the increase in cash flow, as are total capital expenditures.

> Meanwhile, ESAI noted that more cash for exploration and development (E&D) activities has been invested abroad than domestically. This trend is more evident in oil spending, but natural gas spending may follow suit if global (LNG). This partially explains the declining reserve replacement ratio for natural gas, says ESAI.[38]
>
> We do not see the level of increased domestic production activity from the international majors and certain large North American independents that we would expect to see in a rational, competitive marketplace at current gas prices, which have been at a sustained average annual price of greater than $5.00 per MMBtu since mid-2002. Are these producers not investing in North American production at the levels that would be expected in a competitive marketplace, one that provides appropriate price signals related to supply/demand fundamentals? Rather than investing for incremental production that will produce supplies with the lowest possible incremental cost to meet domestic demands, are these producers investing in overseas projects, because their investment capital can yield a greater and faster return... [T]he multinationals

appear to be taking the "windfall" profits from high domestic gas prices to invest in overseas projects largely owned by foreign national oil companies that they believe offer better investment opportunities, perhaps with net cash-flow payout in two-three years... The flight overseas by dollars realized from domestic gas prices realized since 2000...effectively means that the American consuming public is financing international projects. Such activity, in turn, helps to support the continued high level of domestic gas prices by resulting in a reduced level of domestic production with an increased per-unit cost than would otherwise be indicated by the level of domestic prices.[39]

D. Short Run Factors

The impact of the hurricanes on Gulf Coast production has been the focal point of the price increase story in the short-term. Interestingly, projections of a severe hurricane season were reported to have driven the price up prior to the occurrence of the actual hurricanes. Year-over-year prices were up over one-third even before the hurricanes arrived.

At its height, the loss of production was about 10 percent of national capacity, although it has been noted that at the height of the production loss there was also a great deal of demand destruction on the Gulf Coast. Thus, the loss of gas available to the market was considerably smaller than the loss of output in the Gulf. Some estimates put this figure as high as a third of the total loss of production. These underlying fundamentals were evident throughout.

> **September 9, 2005** – Even though 8% to 16% of daily gas supplies have disappeared in Hurricane Katrina's wake, markets across the country have managed to stay whole largely because of a significant drop in demand, particularly in the Gulf Coast region, industry officials said Tuesday.
>
> Merrill Lynch's top exploration-and-production analyst thinks much of the natural gas supply shortages caused by Hurricane Katrina will be offset by losses of industrial and commercial demand caused by the same storm.
>
> "There is no doubt that the Street will fixate on just supplies, but one needs to consider the demand effects.'[40]
>
> **October 10, 2005** – While data in the two weeks after Katrina made landfall Aug. 29 "suggested that enough demand had disappeared due to the storm that we are roughly in supply/demand balance, the additional damage creates the fear that demand will recover more quickly than our supply will come back," Elder said.[41]
>
> **November 18, 2005** – "I think the surprising thing continues to be that the demand destruction going on has more than offset any missing Gulf gas," said Smith, President of Natchez, Miss.-based Stephen Smith Energy Associates.

And even though prices have come off their peaks in most regions, it may take weeks for that to translate into restored industrial consumption.[42]

November 30, 2005 – [E]ven with hurricane-related shut-ins exceeding 450Bcf [billion cubic feet] from offshore Gulf of Mexico facilities and probably another 100 Bcf from onshore Gulf coast facilities, storage levels as of mid-Novembers are almost 3.3 Tcf [Trillion cubic feet]. The notion that storage could be near 3.3 Tcf in mid-November despite 550 Bcf of shut-in production is mind-boggling. Since the weather during September through mid-November was fairly mild, a small amount of this unexpectedly high storage level could be attributed to reduced weather-sensitive loads. The vast majority, however, must relate either to physical limitations on loads because of hurricane damage (e.g., refineries under water) or price sensitive demand destruction in otherwise available facilities (e.g., shut-in ammonia)... These weather related reductions are now greater than the continuing estimated shut in production.[43]

January 23, 2005 – Many experts had estimated that as much as 3 bcf/day of Outer Continental Shelf production would be off-line. According to the Minerals and Management Service, that figure is closer to 1.8 bcf/day as volumes have been restored more quickly than many observers had thought.[44]

Notwithstanding the run up in prices before the hurricanes, by December the spot price had almost doubled again. Shut-in production had been reduced by over half, so the shortfall to the national market was down to three percent. Storage was well above average. With what is likely to go down as one of, if not the, warmest Januaries on record, market fundamentals had shifted in a positive direction. Notwithstanding the effects of recent hurricanes, supply and demand were less tight than before the hurricanes – demand down more than supply. Gas in storage was up over 50 percent, at what is likely to be a historic high (see Exhibit II-15).

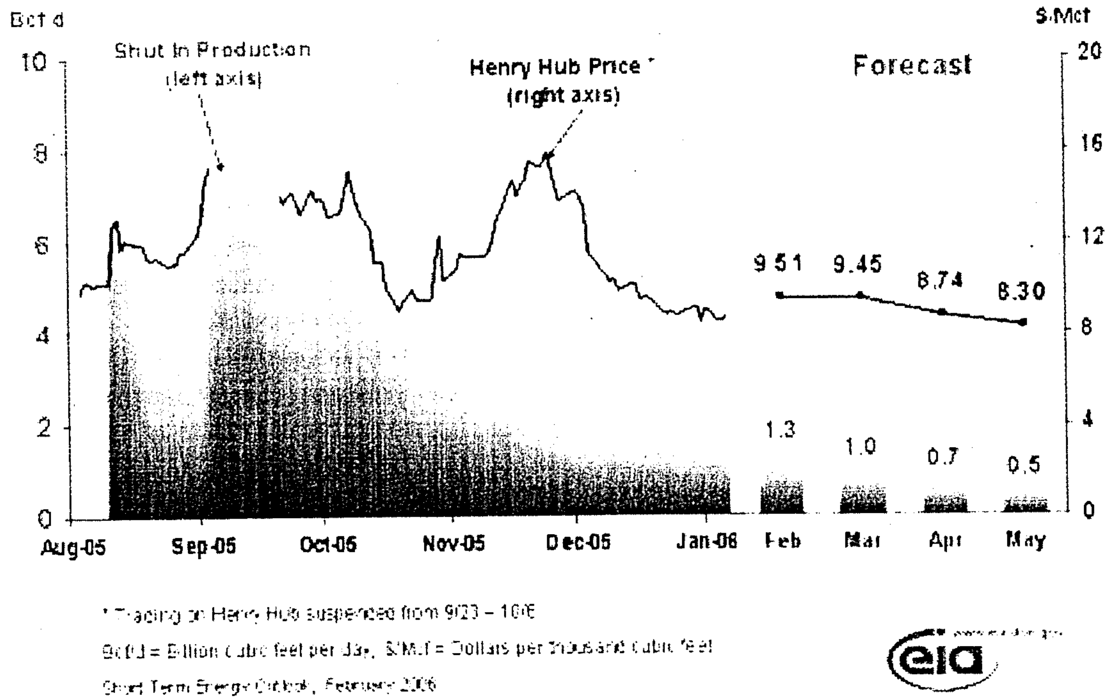
This would suggest that prices should be similar, or even a little lower than they have been in previous years. That is not the case (see Exhibit II-16). They are running about $3.00 higher, up over 60 percent at the wellhead and in the spot market. Futures prices are even higher still, running about 40 percent above current prices and about twice as high as the estimated long run costs of production.

There was also a shift in the domestic price relationship between oil and gas. Throughout the 1990s, the ratio of the price of oil per barrel at the wellhead (West Texas Intermediate) to a thousand cubic feet of natural gas at the wellhead was about 9:1 or 10:1. In recent years, the price of natural gas has increased relative to that of crude. The ratio of wellhead crude to wellhead natural gas has declined, though, to about 6:1 or 7:1.

The correlation between oil and gas prices is a convenient explanation for the shift up in prices and some argue that "oil prices appear to be holding them [natural gas prices] up."[45] Some question whether the correlation actually represents causation. The ability to actually

EXHIBIT II-15: HURRICANES AND PRICES

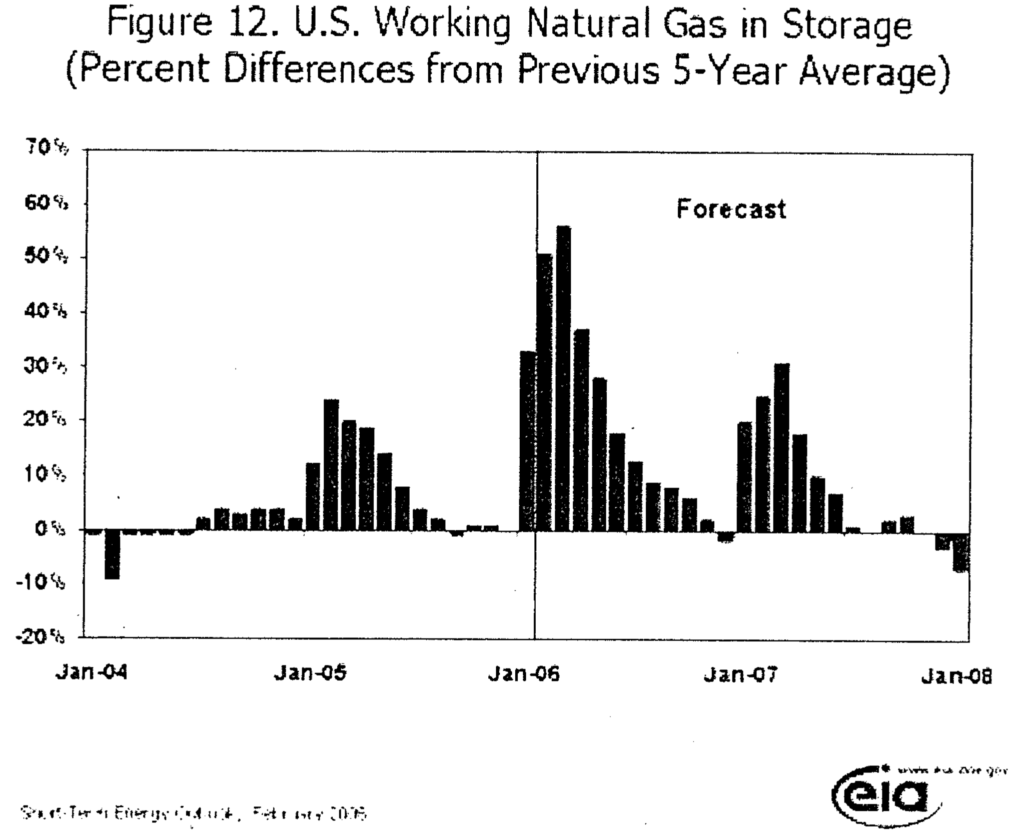
Figure 5. Shut-In Federal Offshore Gulf Natural Gas Production



switch fuels has been declining. Therefore the cross-price elasticity of demand, which has been historically low, has been declining.

> Following up on price effects of the current tight gas market, *Stephen Brown,* from the Federal Reserve Bank of Dallas, as Director of Energy Economics and Microeconomic Policy Analysis, conceded an overall steady gain in energy prices since early 2002, a period in which natural gas spikes closely follow the track of oil prices... The 10-1 Rule ($20 to $2, oil-to-gas price) that was notable prior to the new century, according to Brown, has been supplanted in the past five years by a 6-1 Rule (oil-to-gas price ratio) in a general sense. However, a purportedly more sophisticated model of prices in the marketplace – the Aburnertip parity rule" – would appear to work better as a tracker, accounting for about 70% of the variation in natural gas prices during 1994-2005.
>
> The problem with these models, explained Brown, is the lack of any accounting for the seasonality of gas demand and contemporaneous price shifts

EXHIBIT II-16: DRAMATIC INCREASE IN STORAGE



of the fact that fuel-switching capabilities of utilities seem to have rapidly diminished in recent years.[46]

Only about 1.25 Bcf/d of U.S. natural gas demand can be shed in the short term through two kinds of market adjustment – immediate fuel switching and lower consumption of gas as a feedstock. This is the gist of a recent report by Canadian Energy Research Institution (CERI)...

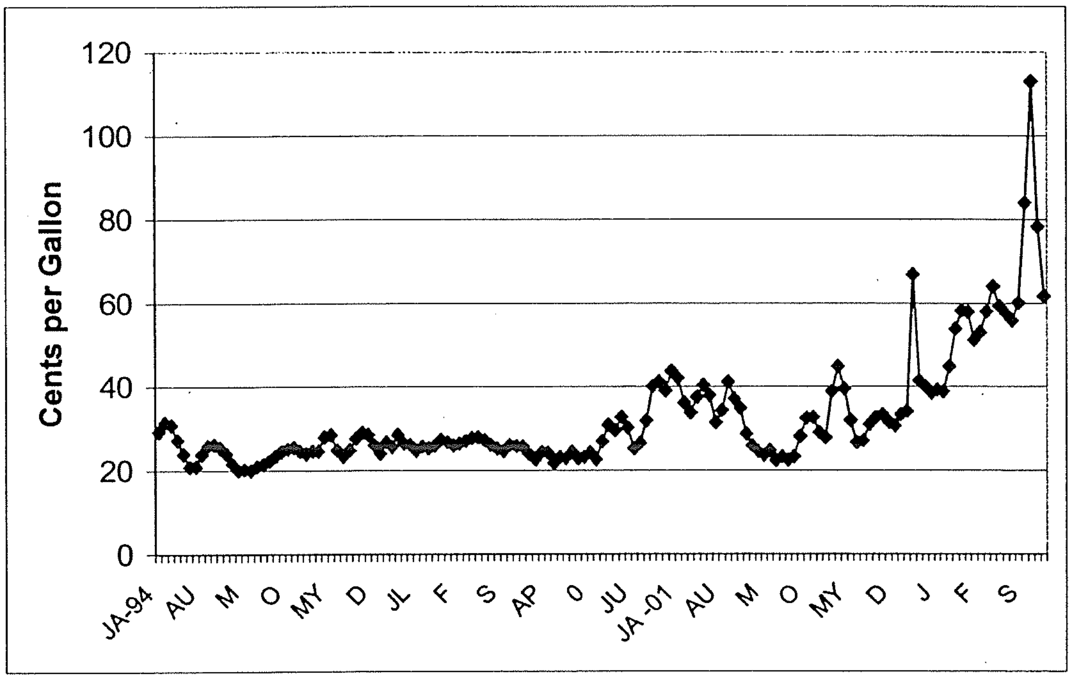
The ability to switch to residual oil (resid) has declined over time due to capital requirements and emissions limits. In many instances the equipment has deteriorated from lack of use and has to be replaced...

Fuel switching from gas to either resid or to distillate creates a short-term reduction of about 0.5 Bcf/d, perhaps tripling over time to 1.5 Bcf/d.[47]

The question about whether this is a mere correlation or a causal relationship is underscored by the complaints we have noted that U.S. gas prices were five or ten times above the prices in other developed nations. Many of those nations pay the same prices for oil but the linkage between oil and gas is not evident. Because the correlation does not represent the actual ability to switch fuels on the demand side, if there is a causal relationship, it may lie on the supply side. In markets dominated by majors producers, who straddle the two fuels, and large traders who play in both commodities, the majors link the prices and holding out for prices that they think reflect the relative value of the fuels.

If we take this view, then we run into a painful irony from the consumer point of view. "Burner-tip parity," or at least the ability to expand the range over which natural gas prices will vary, is influenced by the ability of refiners to increase their margins (see Exhibit II-17). The increase in domestic spread on distillate (diesel) would translate into a substantial price increase for gas, as much as $1.60 per mcf.

EXHIBIT II-17: DOMESTIC SPREAD ON DIESEL
(Retail Minus Crude and Taxes)



Source: Energy Information Administration, Database.

Based on these fundamentals, it does not seem that a 75 percent increase in the wellhead price or a doubling of spot prices as shown in Exhibit I-2 should have taken place. In financial commodity markets, however, perception ("fear and frustration"[48]) may be more influential than facts on the ground. Thus, physical market fundamentals in the short term and long term do not seem to be an adequate explanation for the pricing behavior of recent years. Choukas-Bradley and Douglas summarized this situation as follows.

These extraordinarily high prices for natural gas have occurred during a time of supply and demand balance, a balance that has been the operative characteristic of industry fundamentals for some time. Indeed, from 2003 to 2004, prices increased dramatically despite improved market fundamentals, increasing production, higher rig counts, a robust storage position, relatively mild weather, and tempered demand. Nonetheless, we have been and remain in the midst of a climate of crisis concerning natural gas prices, with market prices subject to wild swings resulting from trading decisions by both commercial and speculative traders that respond to "psychology" and "spin," either in spite of or in the absence of reliable, real-time fundamental information. Trading of the natural gas contract on the NYMEX continues to be dominated by technical trading, with the result that in a period of stability in market fundamentals, the market will tend to see prices remain at high levels if they start at high levels, just as they would remain at moderate levels if they started at moderate levels. That is, part of what is propping up current prices is . . . current prices.[49]

Endnotes

[1] Pirrong, Stephen Craig, *The Economics, Law and Public Policy of Market Power Manipulation* (Boston: Kluwer, 1996), p. 10.
[2] See Bohi, Douglas R. *Analyzing Demand Behavior: A Study of Energy Elasticities* (Baltimore: Johns Hopkins University Press, 1981); Waverman, Leonard, "Econometric Modeling of Energy Demand: When Are Substitutes Good Substitutes?," in David Hawdon, *Energy Demand: Evidence and Expectations* (London: Surrey University Press, 1992), p. 16. Urga, Giovanni and Chris Walters, "Dynamic Translog and Linear Logit Models: A Factor Demand Analysis of Interfuel Substitution in US. Industrial Energy Demand," *Energy Economics*, 25, 2003, p. 18, concludes that "estimates of long run cross elasticities are well below the threshold of unity."
[3] Consodine, Timothy J. and Eunnyeong Heo, "Price and Inventory Dynamics in Petroleum Product Markets," *Energy Economics*, 22, 2000, p. 527, conclude "supply curves for the industry are inelastic and upward sloping." See also "Separability, Functional Form and Regulatory Policy in Models of Interfuel Substitution." *Energy Economics*, 1989.
[4] Pirrong, Stephen Craig, *The Economics, Law and Public Policy of Market Power Manipulation* (Boston: Kluwer, 1996), pp. 10... 24... 59. See also, Williams, Jeffrey and Brian Wright, *Storage and Commodity Markets* (Cambridge: Cambridge University Press, 1991); Deaton, Angus and Guy Laroque, "On the Behavior of Commodity Prices," *Review of Economics and Statistics*, 1992.
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[6] Ewing, Bradley T., Farooq Malik and Ozan Ozfidan, "Volatility Transmission in the Oil and Natural Gas Markets," *Energy Economics*, 24, 2002 p. 536.
[7] Ewing, Bradley T., Farooq Malik and Ozan Ozfidan, "Volatility Transmission in the Oil and Natural Gas Markets," *Energy Economics*, 24, 2002 p. 536.
[8] Pillipovic, Dragana, *Energy Risk: Valuing and Managing Energy Derivates* (New York: McGraw-Hill, 1998), p. 3.
[9] Matthew Seryneck, "Investors Beware," p. 37.
[10] Pirrong, Stephen Craig, *The Economics, Law and Public Policy of Market Power Manipulation* (Boston: Kluwer, 1996), pp. 10... 24... 59. See also, William Jeffrey and Brian Wright, *Storage and Commodity Markets* (1991); Deaton, Angus and Guy Laroque, "On the Behavior of Commodity Prices," *Review of Economics and Statistics*, 1992.
[11] The California Energy Commission, *2005 Integrated Energy Policy Report*, November 2005, p. 133, citing comments of Rich Ferguson, Center for Energy Efficiency and Renewable Technologies, Transcript of the October 7, 2005, Energy Report Hearing on Natural Gas Prices Issues, notes that "that natural gas prices reflect large scarcity rents above the marginal costs of production that consumers are paying." An economic rent is "a payment in excess of what is necessary to keep it at its present occupation. (Pierce, David, W., *The Dictionary of Modern Economics* (Cambridge, MIT Press, 1984). P. 124.
[12] Foster Report, No. 2558, p. 13.
[13] From National Petroleum Council web site.
[14] National Petroleum Council, *Natural Gas: Meeting the Challenges of the Nationa's Growing Natural Gas Demand*, 1999, p. 36.
[15] Energy Information Administration, *Annual Energy Outlook* 1999 (Washington, D.C.: U.S. Department of Energy, 1999), pp. 74-75.
[16] NPC, 2003, p. 5.
[17] Energy Information Administration, *Annual Energy Outlook* (Washington, D.C.: 2003), p. 2.
[18] NPC 2003, p. 7.
[19] Costello, et al., p. 22.
[20] Foster Report, No. 2558.
[21] Foster Report, No 2562, October 20, 2005, p. 37.

[22] Id.
[23] Id., p. 31.
[24] Foster Report, No. 2546, June 23, 2005, p. 32.
[25] Beattie, Jeff, "U.S. Oil and Gas Producers Investing in Mergers, Not More Drilling – S&P," *Energy Daily*, April 26, 2004.
[26] Russell Gold, "Big Oil Firms Join Hunt for Natural Gas in U.S.," *The Wall Street Journal*, November 29, 2005, A1.
[27] Foster Report No 2576, January 27, 2006, p. 17.
[28] Platts, *Gas Daily*, Jan 17, 2006, pp. 1Y 6.
[29] Platts, *Gas Daily* September 27, 2005, p. 4.
[30] Gold, "Big Oil," p. A15.
[31] Foster Report, No. 2538, p. 2.
[32] Platts, *Gas Daily*, February 7, 2006, p. 6.
[33] Foster Report 2563, October 20, 2005, p. 20.
[34] Norris, Floyd, "High Profits, Sluggish Investment," *New York Times*, February 3, 2006, p. C-1.
[35] Floyd, "Sluggish Investment," p. C-1.
[36] Floyd, "Sluggish Investment," p. C-1.
[37] Floyd, "Sluggish Investment," p. C-1.
[38] Foster Report, No. 2546, June 23, 2005, p. 32.
[39] Choukas-Bradley, James R. and Michael Donnelly, *A Report on Projected Natural Gas Prices and Dynamics of the Natural Gas Market for 2005 and Beyond*, February 11, 2005.
[40] Platts, *Gas Daily*, Sept. 9 2005, p. 6.
[41] Platts, *Gas Daily*, October 10, 2005, p. 6.
[42] Platts, *Gas Daily*, November 18, 2005, p. 3.
[43] Chernoff, "Unusual Signals."
[44] Platts, *Gas Daily*, Jan. 23, 2005, p. 4.
[45] FERC, The Basics, p. 2.
[46] Foster Report No. 2576, January 27, 2005, p. 14.
[47] Foster Report, No. 2536, pp. 25., 26.
[48] Barrionuevo, "Energy Trading," p. 3-3.
[49] Choukas-Bradley, James and Michael F. Donnelly, *A Report on Projected Natural Gas Prices and Dynamics of the Natural Gas Market for 2005 and Beyond*, February 11, 2005, pp. 1-2.